GAS GENERATOR FOR LOW-SLAG GAS CARTRIDGES FOR MOTOR VEHICLE SAFETY

BACKGROUND AND SUMMARY OF THE INVENTION

The invention relates to a gas generator, especially for an airbag, with two tubes arranged concentrically one in the other, the inner tube forming the combustion chamber, containing the fuel and being closed with a cover plate and an end plate.

Gas generators, mainly those having solid gassing charges in the form of tablets, are required especially for the inflation of air bags for motor vehicle safety, e.g., for drivers or passengers, or for side air bags. These are installed in motor vehicles and are an essential part of motor vehicle safety.

In the gas generators for inflatable collision cushions that are used at this time, the combustible, gas developing material is a gassing charge in tablet form, plate form, or granules. Upon deflagration, this gassing charge produces the pressure to inflate the collision cushion. The disadvantage of the combustion of solid gas-generating materials consists in the rather great mount of slag produced by the combustion, which can amount to more than 50% of the mass of the gassing charge. Due to the formation of slag and dust by the burn, expensive filter stages are necessary in the gas generation in order to withhold slag and dust particles. Otherwise, the collision cushion would be damaged by the discharge of these particles and the occupants could be endangered.

As alternatives to these gassing charges, there are generators with compressed gases or air. To form a sufficient gas volume, very high charging pressures are necessary, since as the gases are released chilling occurs, and no gain of volume is achieved by exothermic

reactions as in the case of solid mixtures. To compensate for the chilling a solid propellant is often used, which only due to the heat produced by its deflagration and the additional production of gas assures the operation of this gas generator.

The present invention describes such gas generators for use in motor vehicle interiors for filling gas bags serving for the protection of occupants. The gas generator is characterized by the use of nitrous oxide (laughing gas) as oxidizer and various organic substances such as polyethylene, starch or paraffin as fuel. This gas generating substance has already been described in WO 00/48 987.

An object of the invention is to provide an improved a gas generator, especially for an airbag with two tubes arranged concentrically one in the other, the inner tube forming the combustion chamber, containing the fuel and being closed with a cover plate and an end plate such that it is especially suited for the use of laughing gas as a gas producing substance.

This problem is solved by the invention in that the cover plate is joined to the end plate through an igniter tube extending through the combustion chamber; an igniter element is disposed in the cover plate and its opening for discharging the ignition gases is connected to the igniter tube; and a longitudinally displaceable piston is arranged in the igniter tube. Radial openings into the combustion chamber are provided and the igniter tube is joined to an outlet in the end plate.

In a preferred embodiment, a discharge chamber is provided in the end plate, into which the outlet of the igniter tube opens and the discharge chamber is connected to an

afterburning chamber disposed between the outer tube and the inner tube.

The piston is joined for the defined control of movement to the cover plate preferably by a break-away edge.

To prevent the piston from blocking the discharge openings after the ignition when it passes through the igniter tube, in a preferred embodiment a receiver for the piston is disposed in the discharge chamber following, in the direction of flow, the discharge openings. A means for trapping the piston can be disposed in this receiver.

For a more uniform ignition of the fuel, the number of the radial openings in the igniter tube advantageously increases toward the discharge chamber. Likewise the size of the openings can increase.

Discharge openings are provided in the outer tube and the gas can exit through them.

Preferably the discharge openings are closed by a membrane, and the membrane at the discharge openings bursts due to the movement of the piston after the ignition element ignites.

Cooling means are preferably arranged in the afterburning element to cool the outflowing gases.

According to the invention, this gas generator if preferentially suitable for a fuel of nitrous oxide (laughing gas) as oxidizer and various organic substances such as polyethylene, starch or paraffin.

In comparison with the current state of the art on the basis of solids in the form of tablets, this solution has the advantage of lower ejection of solids after the charge has

burned. This feature is gaining increasing importance due to safety aspects with respect to the occupants of vehicles, especially those with health problems such as might occur in the firing of the generators in the case of asthmatics.

BRIEF DESCRIPTION OF THE DRAWING

The drawing is an embodiment of a gas generator according to the invention.

DETAILED DESCRIPTION

The gas generator according to the invention is represented in the single drawing. It can consist of the illustrated components with the main feature of zone ignition, valve operation, fuel containers and afterburning space for cooling.

The gas generator consists of an outer tube 9 with radial openings 8, in which an inner tube 10 is concentrically arranged. The inner tube 10 is closed by a cover plate 11 and an end plate 12 at its extremities. Cover plate 11 and end plate 12 are joined together by an igniter tube 7. An igniter element 1 is loaded into the cover plate 11 and its ignition gas outlet communicates with the igniter tube 7.

In the igniter tube 7 a piston 2 is inserted, which is joined to cover plate 11 by a break-away edge 14. The piston 2 can be in contact with the inner wall of the igniter tube 7 through O-rings or sealing rings.

In the end plate 12 there is provided a discharge chamber 13 into which the igniter tube 7 leads. This discharge chamber 13 is connected by openings to the afterburning chamber 5 between outer tube 9 and inner tube 10.

Downstream from the discharge openings 4 an area to receive the piston 2 is provided in

the discharge chamber. Cooling elements 16 are disposed in the afterburning chamber 5.

In operation, after ignition, for example by electrical igniters 1 as in EP 0 618 424 B1, with SINCO, for example, as an intensifying charge as described in EP 0 809 616 A1, and with the thermal safety device as described in EP 0 914 305 A1, a piston 2 is driven which, among other things, releases openings 6 step by step, whereby a zoned ignition of the fuel and oxidizer – mixture 3 – is made possible. The fuel 3 is ideally arranged annularly around the igniter tube 7, the fuel being held on stainless steel meshes, for example, or combustible materials in the form of fabric woven from fully combustible fibers such as cellulose, for example. Another function of the piston is finally the punching out of the blast openings 4. The opening action can be controlled by the appropriate selection of, for example, the mass of the piston, the distance to be traveled, or the ignition power. After the opening action, the combustion gases enter an afterburning chamber 5. Here an effective cooling can be achieved by suitable measures such as bunches of wire, ceramic supports or substances that can be vaporized or thermally decomposed, such as carbonates, oxalic acid, oxalates, and others.

The discharge openings 8 in the igniter tube 7 can advantageously be arranged at closer intervals toward the blast openings 4, thereby achieving a more uniform ignition of the fuel 3.

The discharge openings 8 and the blast openings 4 can be sealed with a membrane.

Other embodiments of the present invention will be readily apparent to those skilled in the art and are intended to be within the scope of the claims appended hereto.